(12) INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

(19) World Intellectual Property Organization
International Bureau

(43) International Publication Date
31 October 2002 (31.10.2002)

PCT

(10) International Publication Number
WO 02/085144 A1

(51) International Patent Classification[7]: A24C 5/35, B65G 47/51

(21) International Application Number: PCT/IT02/00240

(22) International Filing Date: 17 April 2002 (17.04.2002)

(25) Filing Language: English

(26) Publication Language: English

(30) Priority Data:
BO2001A000227 18 April 2001 (18.04.2001) IT

(71) Applicant *(for all designated States except US)*: **G.D. SOCIETA' PER AZIONI** [IT/IT]; Via Battindarno, 91, I-40133 Bologna (IT).

(72) Inventor; and

(75) Inventor/Applicant *(for US only)*: **SPATAFORA, Mario** [IT/IT]; Via del Lavoro, 56, I-40100 Bologna (IT).

(74) Agents: **JORIO, Paolo** et al.; c/o Studio Torta S.r.l., Via Viotti, 9, I-10121 Torino (IT).

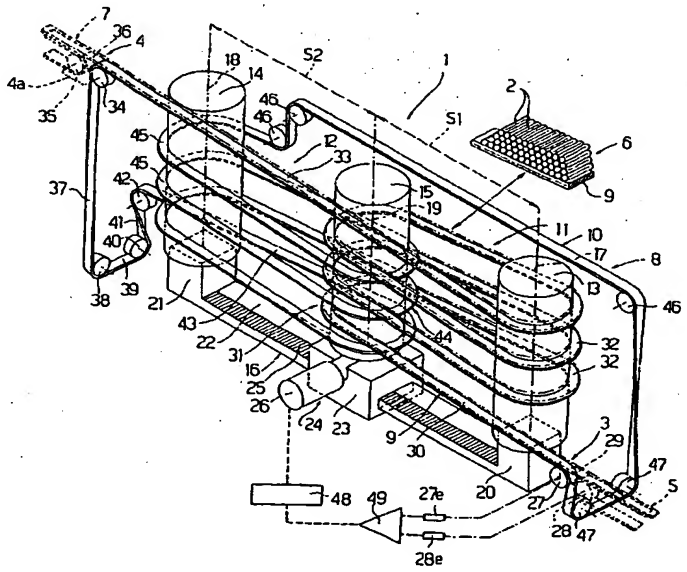
(81) Designated States *(national)*: AE, AG, AL, AM, AT, AU, AZ, BA, BB, BG, BR, BY, BZ, CA, CH, CN, CO, CR, CU, CZ, DE, DK, DM, DZ, EC, EE, ES, FI, GB, GD, GE, GH, GM, HR, HU, ID, IL, IN, IS, JP, KE, KG, KP, KR, KZ, LC, LK, LR, LS, LT, LU, LV, MA, MD, MG, MK, MN, MW, MX, MZ, NO, NZ, OM, PH, PL, PT, RO, RU, SD, SE, SG, SI, SK, SL, TJ, TM, TN, TR, TT, TZ, UA, UG, US, UZ, VN, YU, ZA, ZM, ZW.

(84) Designated States *(regional)*: ARIPO patent (GH, GM, KE, LS, MW, MZ, SD, SL, SZ, TZ, UG, ZM, ZW), Eurasian patent (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), European patent (AT, BE, CH, CY, DE, DK, ES, FI, FR, GB, GR, IE, IT, LU, MC, NL, PT, SE, TR), OAPI patent (BF, BJ, CF, CG, CI, CM, GA, GN, GQ, GW, ML, MR, NE, SN, TD, TG).

Published:
— *with international search report*

For two-letter codes and other abbreviations, refer to the "Guidance Notes on Codes and Abbreviations" appearing at the beginning of each regular issue of the PCT Gazette.

(54) **Title:** VARIABLE-CAPACITY STORE FOR ELONGATED ELEMENTS



(57) **Abstract:** A variable-capacity store (1; 50) for elongated elements (2), in particular tobacco articles, wherein an endless conveyor (8) has a conveying branch (9) for transferring the elongated elements (2) from an input station (3) to an output station (4) of the store (1; 50), and a return branch (10) extending from the output station (4) to the input station (3); each branch (9; 10) is coiled about a relative pair (11; 12) of transmission members, (13, 15; 14, 15); and the two pairs (11; 12) of transmission members (13, 15) (14, 15) share a transmission member (15) movable transversely in controlled manner.

WO 02/085144 A1

VARIABLE-CAPACITY STORE FOR ELONGATED ELEMENTS

TECHNICAL FIELD

The present invention relates to a variable-capacity store for elongated elements.

The present invention may be used to advantage for storing cigarettes, to which the following description refers purely by way of example.

BACKGROUND ART

For storing cigarettes, a variable-capacity store is interposed between a cigarette manufacturing machine and a packing machine to compensate for any difference between the number of cigarettes produced and the number packed.

Patent EP - 0 738 478 describes a variable-capacity store of the "first in-first out" type, which comprises an endless conveyor having a conveying branch for transferring a continuous stream of cigarettes from an input station to an output station of the store, and a return branch extending from the output station to the input station. Each branch is coiled about a pair of rotary transmission members, normally vertical-axis

drums, movable transversely with respect to each other; and each pair of transmission members is associated with an actuating device for varying the distance between the axes of the transmission members in the pair, and which is connected to the other actuator device to adjust the lengths of the two branches in complementary manner.

Though efficient, the above known store has proved unsuitable for use on cigarette packing plants, on account of its size and the number of moving parts and relative actuating devices.

DISCLOSURE OF INVENTION

It is an object of the present invention to provide a variable-capacity "first in-first out" store, which has the same functional advantages as the known store described above, but which is compact and comprises a minimum number of moving parts and actuating devices.

According to the present invention, there is provided a variable-capacity store for elongated elements, in particular tobacco articles, the store comprising an input station and an output station arranged in series along a path of the elongated elements; and an endless conveyor having a conveying branch for transferring the elongated elements from said input station to said output station, and a return branch extending from the output station to the input station; each said branch being wound about a relative pair of transmission members movable transversely with respect to each other; and being characterized in that the

transmission members of each said pair of transmission members have one of the relative said two transmission members in common with the other said pair.

In a preferred embodiment of the store defined above, said transmission members are three in number and arranged parallel and side by side; more specifically, the three transmission members preferably comprise two fixed outer transmission members, and a movable intermediate transmission member; and actuating means are provided to move said intermediate transmission member between said outer transmission members.

BRIEF DESCRIPTION OF THE DRAWINGS

A number of non-limiting embodiments of the present invention will be described by way of example with reference to the accompanying drawings, in which:

Figure 1 shows a view in perspective, with parts removed for clarity, of a first preferred embodiment of the store according to the present invention;

Figure 2 shows a view in perspective, with parts removed for clarity, of a second preferred embodiment of the store according to the present invention.

BEST MODE FOR CARRYING OUT THE INVENTION

Number 1 in Figure 1 indicates as a whole a variable-capacity store for cigarettes 2, comprising an input station 3 and an output station 4 arranged in series along a path of cigarettes 2. More specifically, store 1 provides for storing a number of cigarettes 2 varying as required within a given range, and for feeding

to station 4 the cigarettes 2 first entering store 1, in use, at station 3.

At input station 3, store 1 receives a continuous stream 6 of cigarettes 2 from an output conveyor 5 of a manufacturing machine (not shown), and feeds stream 6 to an input conveyor 7 of a packing machine (not shown) connected to store 1 at station 4.

Store 1 comprises an endless conveyor 8 having a conveying branch 9 extending, and for conveying cigarettes 2, from station 3 to station 4, and a return branch 10 extending from station 4 to station 3. Branches 9 and 10 are wound about relative pairs 11 and 12 of transmission members, each of which has one of the relative two transmission members in common with the other pair. More specifically, the transmission members comprise three drums 13, 14 and 15, mounted side by side on a support 16 to rotate about respective vertical axes 17, 18 and 19, and of which drum 13 forms part of pair 11, drum 14 forms part of pair 12, and drum 15 is an intermediate drum between the other two and common to both pairs 11 and 12.

Support 16 is defined by a straight beam comprising two fixed end blocks 20 and 21, and a rail 22 connecting blocks 20 and 21 and supporting an axial slide 23. Blocks 20 and 21 support respective drums 13 and 14, which are fixed transversely with respect to rail 22 and have a center distance S; while slide 23 supports drum 15, which has a variable center distance S1 with respect to drum

13, and a variable center distance S2 - complementary to S1, where S1+S2=S - with respect to drum 14.

Drum 15 is moved transversely along rail 22 between blocks 20 and 21 by an actuating device 24, which, in addition to slide 23, comprises a rack 25 located along rail 22, and a motor 26 carried by slide 23 and having an output member defined by a pinion (not shown) connected to rack 25 by a rack-pinion coupling (not shown).

Conveyor 8 is defined by a belt conveyor of a total length L, wherein conveying branch 9 is of a length L1 varying with the transverse position of drum 15, and is detoured in a horizontal direction, parallel to rail 22, by an input pulley 27 mounted at input station 3 to rotate about a horizontal axis substantially perpendicular to guide 22 and located parallel and adjacent to the axis of a transmission pulley 28 of conveyor 5, which is connected to conveying branch 9 by a plate 29 between pulleys 27 and 28. Pulleys 27 and 28 have respective encoders 27e and 28e for emitting respective signals proportional to the surface speeds of pulleys 27 and 28.

As of pulley 27, conveying branch 9 extends by a substantially horizontal portion 30 up to drum 15; winds upwards about drums 13 and 15 in pair 11 to form a coil 31 defined by a succession of turns 32 arranged with a given spacing P1 and each wound about drum 13 and drum 15; and, finally, extends from drum 13 to output station 4 by a substantially horizontal portion 33. Coil 31 is

supported in known manner by drums 13 and 15. For example, in a first embodiment of drums 13 and 15, coil 31 is supported by helical grooves (not shown) formed in the outer surfaces of drums 13 and 15. In an alternative embodiment of drums 13 and 15, each drum 13, 15 is defined by a cylindrical supporting member having a central axis coincident with axis 17, 19 of respective drum 13, 15, and by a number of disks (not shown) mounted to rotate idly on the cylindrical member, and each of which acts as a supporting member for coil 31 of conveying branch 9.

The output end of portion 33 is detoured downwards by a powered output pulley 34, which powers conveyor 8 and is mounted at output station 4 to rotate about a horizontal axis substantially perpendicular to rail 22 and parallel and adjacent to the axis of a transmission pulley 35 of conveyor 7. Conveyor 7 is connected to conveying branch 9 by a plate 36 between pulleys 34 and 35, which are connected to each other in known manner by an electric axis 4a so as to rotate, in use, at the same surface speed at all times.

Return branch 10 is of a length L2 variable with the transverse position of drum 15 and complementary to length L1, where L1+L2=1, and comprises an initial portion 37, which extends downwards from the periphery of pulley 34, twists 90° about a vertical axis, and is detoured in a horizontal direction perpendicular to rail 22 by a pulley 38, having an axis parallel to rail 22, to

form a horizontal portion 39, which is in turn detoured upwards by a pulley 40, parallel to pulley 38, to form a vertical portion 41. Portion 41 twists 90° about a vertical axis, and is detoured by a pulley 42, having a horizontal axis perpendicular to rail 22, to form a substantially horizontal portion 43 extending up to drum 15 in a substantially parallel direction opposite that of portion 30. Return branch 10 then winds upwards about drums 14 and 15 in pair 12 to form a coil 44 defined by a succession of turns 45 arranged with a given spacing P2, which, in the example shown, is the same as P1. Each turn 45 winds about and is supported in known manner by drums 14 and 15, and is located, about the periphery of drum 15, in an intermediate position between two adjacent turns 32.

For example, in a first embodiment of drums 14 and 15, coil 44 is supported by helical grooves (not shown) formed in the outer surfaces of drums 14 and 15. In an alternative embodiment of drums 14 and 15, each drum 14, 15 is defined by a cylindrical supporting member having a central axis coincident with axis 18, 19 of respective drum 14, 15, and by a number of disks (not shown) mounted to rotate idly on the cylindrical member, and each of which acts as a supporting member for coil 44 of return branch 10.

At the output of coil 44, return branch 10 is detoured towards pulley 27 by a number of pulleys 46 parallel to pulley 42, and by two end pulleys 47 parallel

to pulley 40.

Store 1 also comprises a known central control unit 48 connected to motor 26 and for controlling actuating device 24 to adjust distances S1 and S2, and therefore lengths L1 and L2, in complementary manner. Central control unit 48 is also connected to a comparing circuit 49, which receives the output signals from each encoder 27e, 28e, and supplies central control unit 48 with an error signal, proportional to the difference between the surface speeds of pulleys 27 and 28, to adjust the transverse movement of drum 15 along rail 22.

In actual use, cigarettes 2 are fed continuously by conveyor 5 to input station 3, and therefore over plate 29 on to the initial portion 30 of conveying branch 9, and are fed by conveying branch 9 to output station 4, where the first cigarettes 2 to enter store 1 are fed over plate 36 on to conveyor 7.

In normal operating conditions, the number of cigarettes 2 fed by conveyor 5 to station 3 equals the number of cigarettes 2 absorbed by conveyor 7 at station 4, and the initial portion 30 of conveying branch 9 operates at the same linear speed as conveyor 5, so that circuit 49 supplies a zero error signal to central control unit 48, which keeps slide 23 stationary along rail 22.

When the number of cigarettes 2 fed to station 3 is greater than the number of cigarettes 2 absorbed at station 4, i.e. the linear speed of conveyor 5 is greater

than that of initial portion 30 of conveying branch 9, comparing circuit 49 supplies an error signal to central control unit 48, which moves drum 15 towards drum 14 to increase length L1 and accordingly reduce length L2, so that the speed at which length L1 increases is added, at input station 3, to the linear speed of endless conveyor 8 at output station 4 (always equal to the linear speed of conveyor 7), and the linear speed of initial portion 30 of conveying branch 9 equals the linear speed of conveyor 5.

The difference between the number of cigarettes 2 fed to input station 3 and the number absorbed at output station 4 can, obviously, only persist until drum 15 reaches a limit position substantially contacting drum 14. Beyond which point, the manufacturing machine (not shown) must be slowed down to create a contrary difference, or even stopped.

Conversely, when the number of cigarettes 2 fed to station 3 is smaller than the number of cigarettes 2 absorbed by conveyor 7 at station 4, central control unit 48 moves drum 15 towards drum 13 to operate store 1 in the opposite way to that described above.

The Figure 2 embodiment shows a store 50 substantially identical with store 1, except that, at drum 15, turns 32 and 45 are arranged in series as opposed to alternating as in store 1. In which case, though spacings P1 and P2 of coils 31 and 44 are the same in the example shown, spacing P2 may be much smaller than

P1 to reduce the height of drums 13, 14, 15, seeing as coil 44 carries no cigarettes 2.

CLAIMS

1) A variable-capacity store for elongated elements, in particular tobacco articles, the store (1; 50) comprising an input station (3) and an output station (4) arranged in series along a path (P) of the elongated elements (2); and an endless conveyor (8) having a conveying branch (9) for transferring the elongated elements (2) from said input station (3) to said output station (4), and a return branch (10) extending from the output station (4) to the input station (3); each said branch (9; 10) being wound about a relative pair (11; 12) of transmission members (13, 15; 14, 15) movable transversely with respect to each other; and being characterized in that the transmission members (13, 15; 14, 15) of each said pair (11; 12) of transmission members (13, 15; 14, 15) has one (15) of the relative said two transmission members (13, 15; 14, 15) in common with the other said pair (12; 11).

2) A store as claimed in Claim 1, characterized in that said transmission members (13, 14, 15) total three in number and are arranged parallel and side by side; one (15) of said three transmission members (13, 14, 15) being associated with each other said transmission member (13; 14) to define a respective said pair (11; 12).

3) A store as claimed in Claim 2, characterized in that said three transmission members (13, 14, 15) comprise two fixed outer transmission members (13, 14),

and a movable intermediate transmission member (15) defining said transmission member (15) in common;; and actuating means (24) are provided to move said intermediate transmission member (15) between said outer transmission members (13, 14).

4) A store as claimed in any one of Claims 1 to 3, characterized in that a first said pair (11) of transmission members (13, 15) is connected to said conveying branch (9) to define, along the conveying branch (9), a first coil (31) having an adjustable first length (L1); and a second said pair (12) of transmission members (14, 15) is connected to said return branch (10) to define, along the return branch (10), a second coil (44) having a second length (L2) adjustable in complementary manner with respect to said first length (L1).

5) A store as claimed in Claim 4, characterized in that said first coil (31) is wound about said first pair (11) of transmission members (13, 15) with a given first spacing (P1), and said second coil (44) is wound about said second pair (12) of transmission members (14, 15) with a given second spacing (P1).

6) A store as claimed in Claim 5, characterized in that said first (P1) and said second (P2) spacing are equal.

7) A store as claimed in any one of Claims 4 to 6, characterized in that, along the common said transmission member (15), said first and said second coil (31, 44) are

arranged in series.

8) A store as claimed in any one of Claims 4 to 6, characterized in that, along the common said transmission member (15), said first and said second coil (31, 44) are arranged with respective turns (32, 45) alternating.

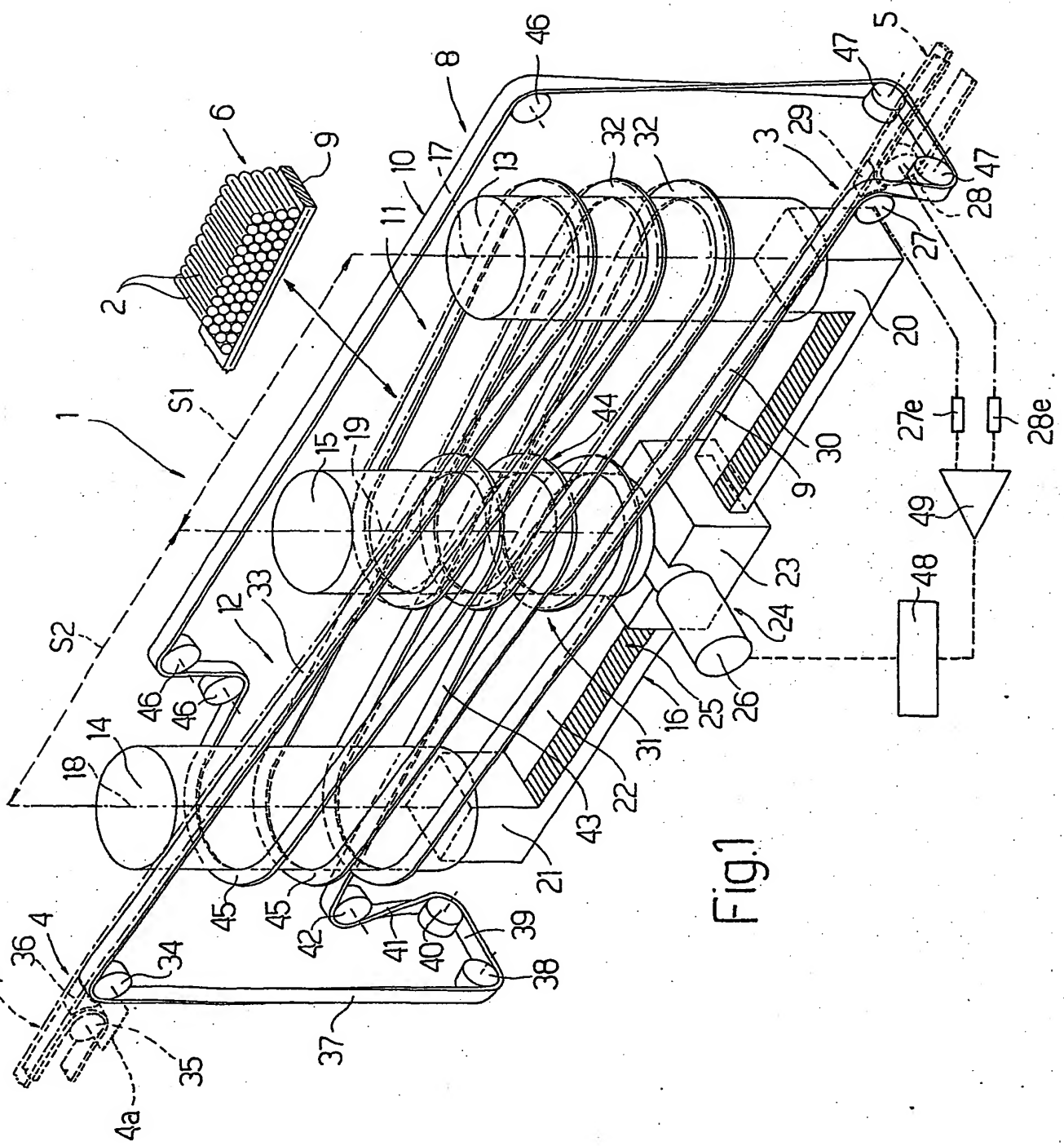

1
2
3
4
4a
5
6
7
8
9
10
11
12
13
14
15
16
17
18
19
20
21
22
23
24
25
26
27
27e
28
28e
29
30
31
32
33
34
35
36
37
38
39
40
41
42
43
44
45
46
47
48
49
S1
S2

Fig.1

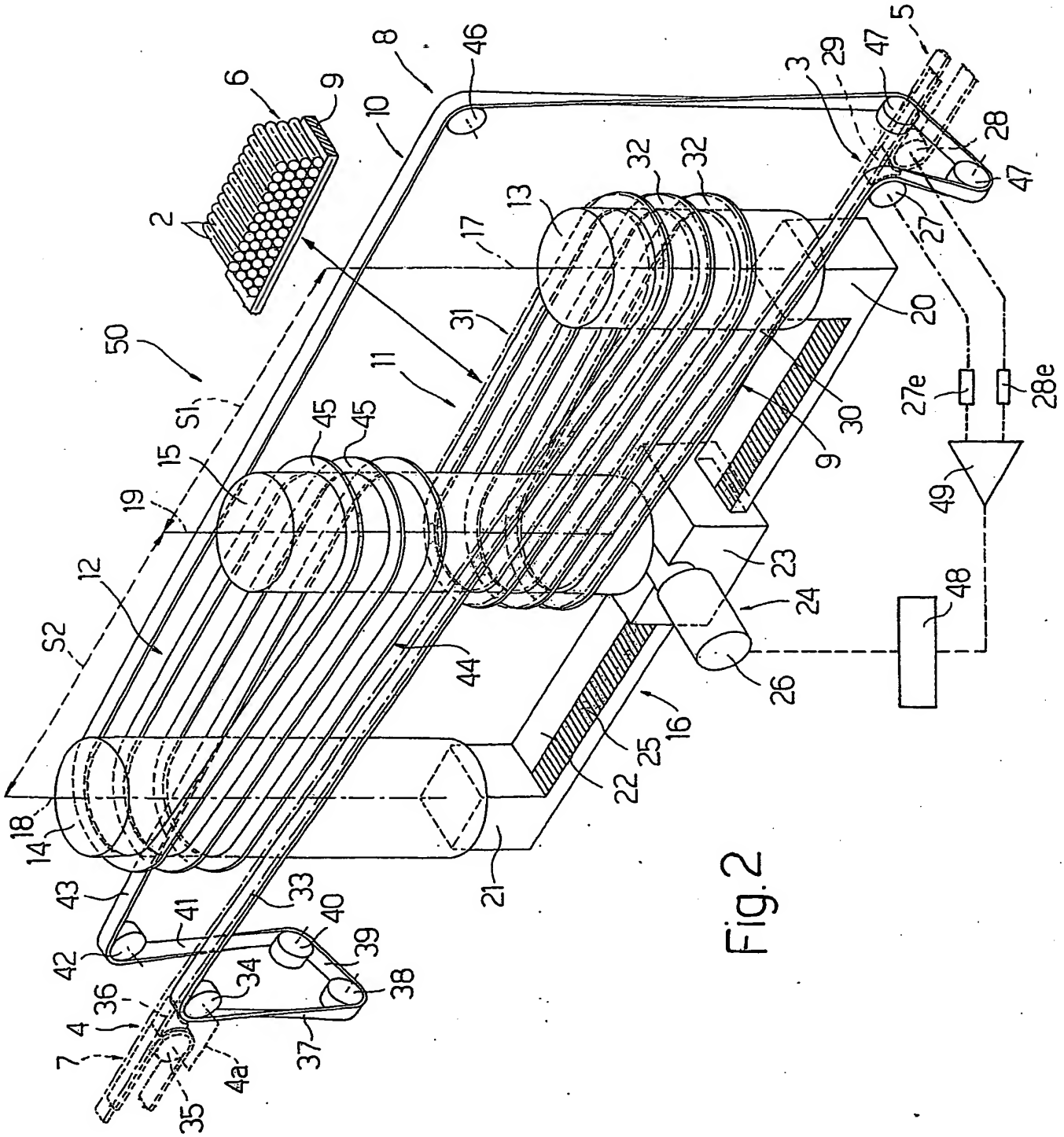

2
3
4
4a
5
6
7
8
9
10
11
12
13
14
15
16
17
18
19
20
21
22
23
24
25
26
27
27e
28
28e
29
30
31
32
32
33
34
35
36
37
38
39
40
41
42
43
44
45
45
46
47
47
48
49
50
S1
S2

Fig.2

INTERNATIONAL SEARCH REPORT

Inte onal Application No
PCT/IT 02/00240

A. CLASSIFICATION OF SUBJECT MATTER
IPC 7 A24C5/35 B65G47/51

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
IPC 7 A24C B65G

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)
EPO-Internal, PAJ, WPI Data

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US 6 065 585 A (CLARKE PETER ALEC ET AL) 23 May 2000 (2000-05-23) column 6, line 24 - line 47; figure 3	1-4
X	GB 1 497 340 A (EGYESUELT IZZOLAMPA) 5 January 1978 (1978-01-05) page 2, line 101 -page 3, line 29; figure 1	1
A	EP 0 738 478 A (GD SPA) 23 October 1996 (1996-10-23) cited in the application the whole document	1-8

☐ Further documents are listed in the continuation of box C.

☒ Patent family members are listed in annex.

* Special categories of cited documents :

"A" document defining the general state of the art which is not considered to be of particular relevance

"E" earlier document but published on or after the international filing date

"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)

"O" document referring to an oral disclosure, use, exhibition or other means

"P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art.

"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
5 August 2002	13/08/2002

Name and mailing address of the ISA	Authorized officer
European Patent Office, P.B. 5818 Patentlaan 2 NL – 2280 HV Rijswijk Tel. (+31–70) 340–2040, Tx. 31 651 epo nl, Fax: (+31–70) 340–3016	MARZANO MONTERO.., M

Form PCT/ISA/210 (second sheet) (July 1992)

INTERNATIONAL SEARCH REPORT

...rmation on patent family members

Inte nal Application No
PCT/IT 02/00240

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
US 6065585 A	23-05-2000	DE 19546079 A1	13-06-1996
		GB 2296000 A ,B	19-06-1996
		GB 2326146 A ,B	16-12-1998
		GB 2331975 A ,B	09-06-1999
		GB 2332662 A ,B	30-06-1999
		IT RM950804 A1	12-06-1996
		US 5845758 A	08-12-1998
		CN 1207019 A ,B	03-02-1999
		DE 69615865 D1	15-11-2001
		DE 69615865 T2	02-05-2002
		EP 0871379 A1	21-10-1998
		WO 9719605 A1	05-06-1997
		JP 2000500977 T	02-02-2000
		US 6227347 B1	08-05-2001
GB 1497340 A	05-01-1978	NONE	
EP 0738478 A	23-10-1996	IT B0950172 A1	18-10-1996
		DE 69609443 D1	31-08-2000
		DE 69609443 T2	01-03-2001
		EP 0738478 A2	23-10-1996